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June 9, 1999

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Re: Application of **Jorg SCHABERNACK and Monika BANZHAF**
MANAGEMENT OF A NETWORK ELEMENT USING MANAGED
OBJECTS IN A DIGITAL COMMUNICATIONS NETWORK
Our Ref. Q54532

Dear Sir:

Attached hereto is the application identified above including 12 sheets of the specification, claims, 2 sheets of formal drawings, executed Assignment and PTO 1595 form, and executed Declaration and Power of Attorney. Also enclosed is the Information Disclosure Statement.

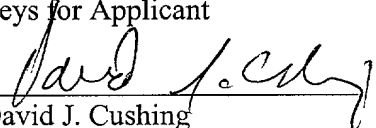
The Government filing fee is calculated as follows:

Total claims	10 - 20	=	0	x	\$18.00	=	\$0.00
Independent claims	2 - 3	=	0	x	\$78.00	=	\$0.00
Base Fee							\$760.00
TOTAL FILING FEE							\$760.00
Recordation of Assignment							\$40.00
TOTAL FEE							\$800.00

Checks for the statutory filing fee of \$760.00 and Assignment recordation fee of \$40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 and 1.17 and any petitions for extension of time under 37 C.F.R. § 1.136 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

Priority is claimed from June 12, 1998 based on German Application No. 19826088.1. The priority document is enclosed herewith.

Respectfully submitted,
SUGHRUE, MION, ZINN,
MACPEAK & SEAS, PLLC
Attorneys for Applicant

By: 
David J. Cushing
Registration No. 28,703

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Jorg SCHABERNACK, et al.

Attorney Docket Q54532

Appln. No.: Not yet assigned

Group Art Unit: Not yet assigned

Filed: June 9, 1999

Examiner: Not yet assigned

For: MANAGEMENT OF A NETWORK ELEMENT USING MANAGED OBJECTS IN A
DIGITAL COMMUNICATIONS NETWORK

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Page 1, after the title, insert the heading: **--Background of the Invention--**.

Page 2, between lines 6 and 7 (not counting paragraph spaces), insert the heading:

--Summary of the Invention--.

Page 3, between lines 26 and 27 (not counting paragraph spaces), insert the heading:

--Brief Description of the Drawings--.

Page 4, between lines 5 and 6 (not counting paragraph spaces), insert the heading:

--Detailed Description of the Invention--.

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PRELIMINARY AMENDMENT
Attorney Docket Q54593

IN THE ABSTRACT:

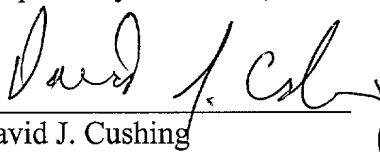
After then heading, delete the title in its entirety.

After the abstract, delete "(Fig. 1).

REMARKS

Entry and consideration of this Amendment is respectfully requested.

Respectfully submitted,



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Date: June 9, 1999

Management of a Network Element Using Managed
Objects in a Digital Communications Network

In digital communications networks, particularly in SDH networks (SDH = Synchronous Digital Hierarchy), a database containing data about the current network configuration is provided for each network element. The network element is managed by a controller using managed objects.

In an article by M. P. Bosse et al entitled "Management von SDH-Netzelementen: eine Anwendung der Informationsmodellierung", which appeared in "Elektrisches Nachrichtenwesen", 4th Quarter 1993, a journal published by the applicant, a method and hardware for managing network elements in digital communications networks are described on pages 329 to 338. With reference to Fig. 2 of the article it is described that SDH network elements are managed with the so-called OSI system management (OSI = Open Systems Interconnection). Management is provided by accessing managed objects, which contain all relevant data. On page 332 of the article, the properties of the managed objects as well as elements used for OSI communication, particularly the common management information system

element (CMISE), are described. The CMISE supports several services for accessing the managed objects. As shown in Fig. 2 of the article, the network element includes a controller and a database MIB (management information base) connected thereto, whose function is not described, however.

It is an object of the invention to provide a method and apparatus for managing a network element using managed objects. The apparatus is to be simple in construction and to enable fast access to the managed objects needed.

This object is attained by a method with the features according to claim 1 and by a network element and a digital communications network with the features according to the respective independent claims.

Accordingly, in response to a request for access to one of the managed objects, a check is made to determine whether this requested object is stored in the memory. If this requested object is not stored in the memory, a check is made to determine whether there is sufficient memory space to write this object into the memory. If there is no sufficient memory space, at least one of the stored objects is swapped out of the memory to a database in accordance with at least one predeterminable criterion. The requested object is then read from the database and written into the memory.

Thus, individual objects are removed from the memory according to predeterminable criteria in order to make room for new requested objects. The old objects are moved to the database, from where they can be written back into the memory if required. As a result, even

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large network elements which must have access to a large number of managed objects require only simple, small-capacity memories while all managed objects are still available.

Further advantageous features are defined in the subclaims.

It is particularly advantageous if, based on the criterion, objects which are frequently accessed remain in the memory. In this manner, swap-out and restoring of objects is required as seldom as possible. Particularly frequently needed objects will thus remain in the memory, which can be accessed very fast. Particularly rarely needed objects will remain in the memory only for the duration of the access.

It is also advantageous if only a predeterminable number of recently accessed objects remain in the memory. Thus, the recently very frequently used objects, i.e., the objects which are very likely to be accessed again, remain in the memory.

The predeterminable criterion is advantageously implemented as a filter function, particularly as a CMISE filter function. The filter function indicates which objects are to remain in the memory. Thus, preferably those objects which have particular properties, such as specific names, attributes, or the like, remain in the memory.

The invention will become more apparent from the following description of an embodiment when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic block diagram showing the interconnection of a controller, a database, and a memory for a network element; and

Fig. 2 is a flowchart showing the steps of the method according to the invention.

Fig. 1 shows schematically the interconnection of the following components of a network element for a digital communications network: a controller FLT, a database DB connected thereto, and a memory MEM connected thereto. Both the database DB and the memory MEM serve to store managed objects. The interconnection forms part of a network element (not shown) for an SDH network. Access to the managed objects is obtained via CMISE requests.

The memory MEM, which is a fast access semiconductor memory, contains objects MO1 and MO2, for example. The database DB, which is implemented on a hard disk, contains objects swapped out of the memory, for example the object MO*. The controller FLT processes requests RQ for access to the objects.

When a request appears at the input of the controller FLT, the latter will control read and write accesses to the semiconductor memory or the hard disk where the corresponding objects are stored. On application of a request for access to a stored object, such as the object MO2, the controller FLT will control the reading of this object MO2 from memory MEM. On application of a request for access to an object not contained in memory MEM, for example the request RQ* for access to the

object MO*, the controller FLT will control the reading of this object MO* from the database DB into the memory.

The controller FLT thus performs a filter function which selects the incoming requests RQ according to whether access to objects in the memory or access to objects no longer or not yet stored in the memory is desired. An additional filter function, particularly the function of a CMISE filter, can be implemented which selects objects based on their properties. Based on attributes, for example, decisions are made as to which objects are to remain in the memory.

The controller FLT further controls the swapping of objects out of the memory MEM to the database DB in order to make room for new objects. Thus, at least the swapped-out objects are stored in the database and remain there for subsequent requests for accesses. It is also possible to use a larger database in which all managed objects are permanently stored. The database DB thus performs a backup function for the memory MEM. If the contents of the memory MEM should be destroyed due to a malfunction, all objects are still available from the database DB.

The operation of the controller FLT will now be described in more detail with reference to Fig. 2, which is a flowchart showing the steps of a method 100 for managing the network element. The method 100 comprises the following steps 110 to 150:

In a first step 110, in response to a request for access to the managed object MO*, a check is made to determine whether this requested object is stored in

If that is not the case, in a step 130, stored objects are swapped out of the memory in accordance with predetermined criteria to make room for the requested object. In this example, the criterion is the frequency of previous accesses to the objects. The most frequently used objects will remain in the memory and will not be swapped out to the database. In this example, a check is made to determine how frequently each of the objects was accessed within a period of half an hour. The frequency is compared with a predetermined minimum. If there is too little memory space, the objects which were accessed with a frequency below the predetermined minimum, i.e., the recently least used objects, will be swapped out of the memory to the database. There is little probability of these objects being used again.

It is also possible to leave only a predeterminable number of those objects in the memory which were recently accessed very often, for example the last ten recently most used objects.

To make room for the requested object MO*, in step 130, the object MO1 shown in Fig. 1, for example, is removed from the memory and written into the database DB, where it can be retrieved for subsequent requests. Thus, less frequently needed objects are swapped out to the database.

In a next step 140, the requested object MO* is transferred from the database DB back into the fast access memory MEM.

In a last step 150, the network element is managed in response to requests (CMISE requests) by accessing the memory and using the objects stored therein.

The above-described method can be summarized as follows:

If the requested object MO* is not yet or no longer stored in the memory (step 110), it will be retrieved from the database and, if there is sufficient memory space (step 120), written (back) into the memory (step 140). Otherwise it can be used immediately. If there is no sufficient memory space (step 120), room has to be made by swapping out "old" objects (step 130). Each request is processed by an access to the memory (step 150).

It is also possible to make room for "new" objects in the memory independently of the current usage of the memory, for example at predetermined time intervals. In this manner, the memory is "cleared up" from time to time and sufficient memory space is provided as a precaution.

The invention is particularly suited for use in SDH network elements, particularly in crossconnects.

Patent Claims

1. A method (100) of managing a network element using managed objects (MO1, MO2, MO*) wherein the network element is managed in response to requests (RQ) by accessing a memory (MEM) and using the objects (MO1, MO2, MO*) stored therein, said method (100) comprising the steps of:

checking in response to a request (RQ = RQ*) for access to one (MO*) of the managed objects (MO1, MO2, MO*) whether this requested object (MO*) is stored in the memory (MEM) (step 110);

if this requested object (MO*) is not stored in the memory (MEM), checking whether there is sufficient memory space to write this object (MO*) into the memory (MEM) (step 120);

if there is no sufficient memory space, swapping at least one (MO1) of the stored objects (MO1, MO2) out of the memory (MEM) to a database (DB) according to at least one predeterminable criterion (step 130);
and

reading the requested object (MO*) from the database(DB) and writing it into the memory (MEM) (step 140).

2. A method (100) as claimed in claim 1 wherein based on the criterion, the objects (MO2) which are accessed most frequently remain in the memory (MEM).
3. A method as claimed in claim 2 wherein only a predeterminable number of recently accessed objects remain in the memory.
4. A method as claimed in claim 1 wherein the predeterminable criterion is a filter function, particularly a CMISE filter function, which indicates which objects are to remain stored in the memory.
5. A method as claimed in claim 1 wherein the predeterminable criterion is a length of time which indicates how long each of the objects may remain stored in the memory.
6. A method as claimed in claim 1 wherein the predeterminable criterion is a maximum number which indicates how many objects may remain stored in the memory.
7. A network element for a digital communications network comprising a controller (FLT) for managing the network element using managed objects (MO1, MO2, MO*), a memory (MEM) connected to the controller (FLT), and a database (DB) connected to the controller (FLT), wherein the controller (FLT), in response to requests (RQ), manages the network element by accessing the memory (MEM) and using the objects (MO1, MO2, MO*)

stored therein, wherein in response to a request (RQ = RQ*) for access to one (MO*) of the managed objects (MO1, MO2, MO*), the controller (FLT) checks whether this requested object (MO*) is stored in the memory, wherein, if this requested object (MO*) is not stored in the memory (MEM), the controller (FLT) checks whether there is sufficient memory space to write this object (MO*) into the memory (MEM), wherein, if there is no sufficient memory space, the controller (FLT) causes at least one (MO1) of the stored objects (MO1, MO2) to be swapped out of the memory (MEM) to a database (DB) according to at least one predeterminable criterion, and wherein the controller (FLT) reads the requested object (MO*) from the database (DB) and writes it into the memory (MEM).

8. A network element as claimed in claim 7 wherein the memory is a semiconductor memory (MEM), and wherein the database (DB) is implemented on a nonvolatile mass storage, particularly on a hard disk.
9. A digital communications network with network elements each comprising a controller (FLT) for managing the network element using managed objects (MO1, MO2, MO*), a memory (MEM) connected to the controller (FLT), and a database (DB) connected to the controller (FLT), wherein the controller (FLT), in response to requests (RQ), manages the network element by accessing the memory (MEM) and using the objects (MO1, MO2, MO*) stored therein, wherein in response to a request (RQ = RQ*) for access to one (MO*) of the managed objects (MO1, MO2, MO*), the controller (FLT) checks whether this requested object (MO*) is stored in the memory, wherein, if this requested object (MO*) is not stored in the memory (MEM), the controller (FLT) checks

whether there is sufficient memory space to write this object (MO*) into the memory (MEM), wherein, if there is no sufficient memory space, the controller (FLT) causes at least one (MO1) of the stored objects (MO1, MO2) to be swapped out of the memory (MEM) to a database (DB) according to at least one predeterminable criterion, and wherein the controller (FLT) reads the requested object (MO*) from the database (DB) and writes it into the memory (MEM).

- 10.A communications network as claimed in claim 9, particularly an SDH network, wherein the network elements are crossconnects, add-drop multiplexers, and/or line multiplexers.

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Abstract of the Disclosure

Management of a Network Element Using Managed
Objects in a Digital Communications Network

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Network elements of a digital communications network, for example of an SDH network (SDH = Synchronous Digital Hierarchy), are managed by controllers using managed objects. To permit fast access to managed objects, a simple circuit with a controller (FLT), a database (DB), and a temporary memory (MEM) is proposed. The controller carries out a method of managing the network element wherein in response to requests (RQ), the objects are stored into the memory and individual objects (MO*) are swapped out to make room for new data according to predeterminal criteria, which specify, for example, the maximum residence time of the object in the memory. At least these objects are transferred to the database (DB). Only upon reception of a request (RQ*) for access to an object (MO*) which is no longer in the memory (MEM) will this object (MO*) be read from the database and transferred back into the memory. The controller manages the network element in response to the requests by accessing the memory and using the objects stored therein.

(Fig. 1)

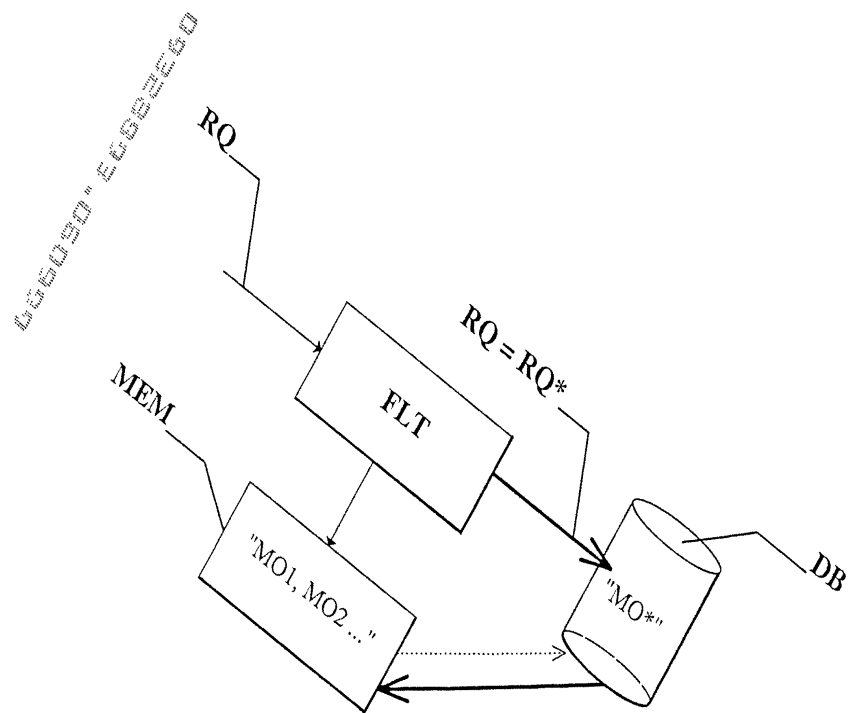


Fig. 1

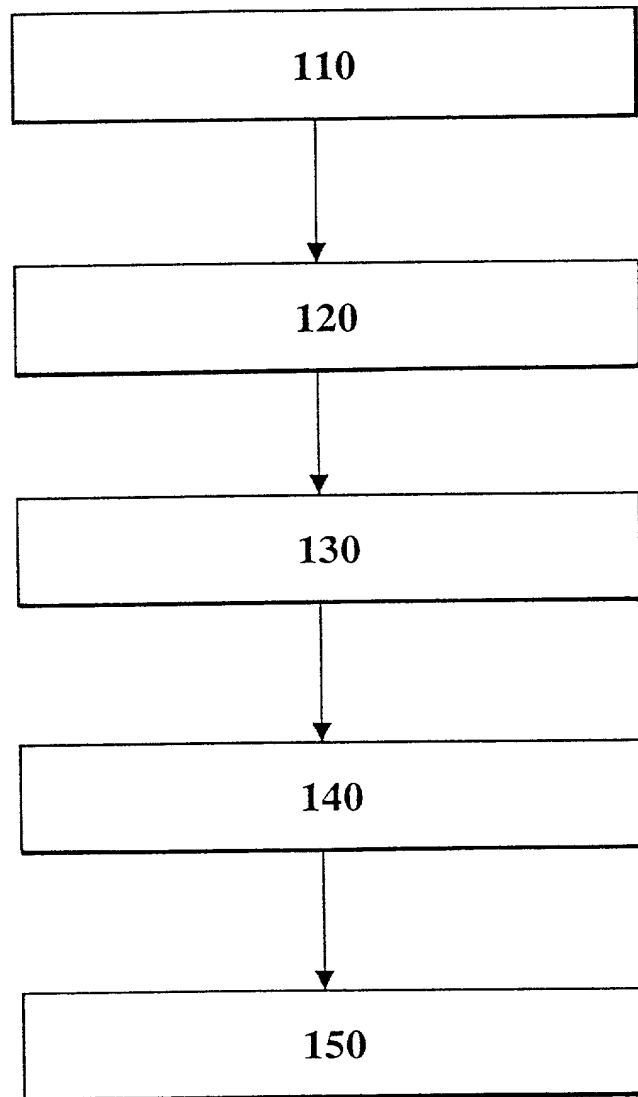


Fig.2

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name: that I verily believe I am an original, first and joint inventor, together with the other inventors listed below, of the subject matter claimed and for which a patent is sought in the application entitled:

Management of a Network Element Using Managed Objects in a Digital Communications Network

which application is:

☐ the attached application
(for original application)

☐
filed

Application Serial No:

, and amended on

(for declaration not accompanying application)

that I have reviewed and understand the contents of the specification of the above-identified application, including the claims, as amended by any amendment referred to above; that I acknowledge my duty to disclose information of which I am aware which is material to the patentability of this application under 37 C.F.R. 1.56, that I hereby claim priority benefits under Title 35, United States Code §119, §172 or §365 of any provisional application or foreign application(s) for patent or inventor's certificate listed below and have also identified on said list any foreign application for patent or inventor's certificate on this invention having a filing date before that of any foreign application on which priority is claimed:

Application Number	Country	Filing Date	Priority Claimed
198 26 088.1	Germany	June 12, 1998	Yes

I hereby claim the benefit of Title 35, United States Code §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in a listed prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge my duty to disclose any information material to the patentability of this application under 37 C.F.R. 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status
------------------------	-------------	--------

I hereby appoint John H. Mion, Reg. No. 18,879; Thomas J. Macpeak, Reg. No. 19,292; Robert J. Seas, Jr., Reg. No. 21,092; Darryl Mexic, Reg. No. 23,063; Robert V. Sloan, Reg. No. 22,775; Peter D. Olexy, Reg. No. 24,513; J. Frank Osha, Reg. No. 24,625; Waddell A. Biggart, Reg. No. 24,861; Louis Gubinsky, Reg. No. 24,835; Neil B. Siegel, Reg. No. 25,200; David J. Cushing, Reg. No. 28,703; John R. Inge, Reg. No. 26,916; Joseph J. Ruch, Jr., Reg. No. 26,577; Sheldon I. Landsman, Reg. No. 25,430; Richard C. Turner, Reg. No. 29,710; Howard L. Bernstein, Reg. No. 25,665; Alan J. Kasper, Reg. No. 25,426; Kenneth J. Burchfiel, Reg. No. 31,333; Gordon Kit, Reg. No. 30,764; Susan J. Mack, Reg. No. 30,951; Frank L. Bernstein, Reg. No. 31,484; Mark Boland, Reg. No. 32,197; William H. Mandir, Reg. No. 32,156; Scott M. Daniels, Reg. No. 32,562; Brian W. Hannon, Reg. No. 32,778; Abraham J. Rosner, Reg. No. 33,276; Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils, Reg. No. 33,102; Brett S. Sylvester, Reg. No. 32,765; and Robert M. Masters, Reg. No. 35,603, my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and request that all correspondence about the application be addressed to **SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC**, 2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037-3213.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Date _____ Third Inventor _____
 First Name Middle Initial Last Name

Residence _____ Signature _____
City State/Country

Post Office Address: _____

Citizenship _____

Date _____ Fourth Inventor _____
 First Name Middle Initial Last Name

Residence _____ Signature _____
City _____ State/Country _____

Post Office Address: _____

Citizenship

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2
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